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August 1944

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PROCESSED PRODUCTS STANDARDIZATION AND INSPECTION DIVISION

✓ INSPECTORS' INSTRUCTIONS

GRADING OF CANNED CORN

PRODUCTION

The annual pack of canned corn varies considerably, from approximately 15,000,000 to 34,000,000 cases. The fluctuation is largely influenced by climatic conditions and market demand.

The principal corn canning areas are in the States of Minnesota, Illinois, Wisconsin, Iowa, Maryland and Delaware, Indiana, Ohio, New York, and Maine. Production figures for 1942 show that of the total pack approximately 23 million cases were Golden (or Yellow) varieties and approximately 10 million cases were White varieties.

There is considerable variation in the types and varieties of corn grown and processed in the different corn canning areas. Each principal producing area strives to grow and pack the type and varieties most favorable to its soil and climatic conditions. Two of the leading areas, for example, pack the Golden type almost exclusively. Illinois and Maine, on the other hand, pack large quantities of both Golden and White types. Iowa, Indiana, and Ohio pack high percentages of White types.

The two recognized types of canned corn are Golden (or Yellow) and White. There are, however, many individual varieties and hybrids within each of these types. The many different hybrids within each type and variety represent the efforts of seed companies and corn packers to improve seed strains, mainly to fit individual area, soil, and climatic conditions. Hybrid seeds of either type have been proven to withstand adverse growing conditions better and to outproduce with a more uniform maturity any of the old line seed stocks formerly used for canning purposes.

There is a greater variation in color and flavor within the White type varieties than in the Golden type varieties. Some varieties, such as Country Gentleman, grown principally in Illinois, have a high natural sugar content, characteristically tender hulls, and a practically uniform white appearance. Other varieties, such as Silver Cross, Evergreen, Narrow-grain, and Crosby, have varying degrees of a lesser natural sugar content, have characteristically tougher hulls, and incline toward color variances in the more advanced stages of maturity. The latter named varieties are grown predominantly in the State of Iowa, and principally in Maryland and Delaware, and Indiana.



Within these White type varieties are many crosses and hybrids, each one varying in some slight characteristic from the others, but the main attribute of all of them is a considerably higher yield to both grower and packer. It is not uncommon, particularly within the Silver Cross hybrid varieties, to note a prominent variation in the color of the kernels, from a white to a bright pale yellow on the same ear of corn. In Golden type varieties distinct variations in color and flavor are not as noticeable as in White type varieties.

The foregoing information on Golden and White types applies solely to "Sweet Corn," which is the terminology used to distinguish corn for canning from "Field Corn." Occasionally a packer will pack field corn in order to increase his pack; he may mix field corn with sweet corn or may pack field corn separately.

GROWING

Sweet corn for canning is planted in measured field plots, the size of which depends upon the capacity of the canning plant. The Golden varieties are the earlier type, followed by the White varieties. By staggering plantings several days apart the corn will normally reach maturity at a time when the canner is able to handle it, consequently making it possible for the packer to maintain a higher quality product over much longer periods, as well as to increase his pack, than would be possible without staggered plantings.

Most packers attempt planting schedules so that they will have completed packing all the Golden corn before the White has reached proper maturity, thus avoiding having to process both types at the same time. Packing both types on the same day's operation means having to clean up the entire machinery line between each type to avoid mixing. In areas where the packer has more than one planting, the White varieties may be planted so as to mature before the entire Golden crop is harvested.

A good corn growing season demands warm weather - the hotter it is the faster the corn matures. In the midwest region where warm nights prevail, the corn usually matures much faster than in most other sections; thus, a plot of corn in that area might be at the proper stage of maturity for a Grade A product one day, but advanced to Grade B on the following day. In sections having cooler nights the corn may hold to the same maturity for several days at a time. Some growing seasons bring on consecutive hot days and nights which places the entire corn acreage ahead of the plant's capacity to handle it, often resulting in the company's decision to either abandon some of the acreage or pack a product too far advanced in maturity for other than a relatively low quality.

HARVESTING

The harvesting of sweet corn is all done by hand although several large firms are at the present time experimenting with machine pickers similar to those used to pick field corn.

After the corn is hand-snapped in the field it is hauled to the canning plant in large field wagons or trucks, weighed and unloaded into a conveyor which carries it directly to the machine lines or to a holding

yard or bin where each load may be held separately. This enables the canner to blend loads of different maturities or to run loads of similar maturity separately. A method of determining the quality of the raw material coming into the factory is most desirable unless the field department of the firm is most efficient in supervising the harvesting of the plots of corn at the right stage of maturity.

PREPARATION AND CANNING

From the holding yard or bins the corn enters a conveyor which carries it to the husking machines. The husking machines automatically trim off the ends of the ears and remove the husks. The huskers may be of either single or double capacity. 13

The ears are conveyed from the huskers to rotary washers which remove much of the dirt and silk adhering to the kernels. 14

In many plants, depending upon the raw material and the carefulness of the packer, before the ears are conveyed to the cutting machines they are inspected for defects and ears of advanced maturity. Ears of advanced maturity are removed and diverted for running with loads of similar maturity. Defective ears are trimmed of defects or removed. 15

Continuous belts move the husked and washed ears to the packing line for the various styles; cream-style, whole-grain, or corn on the cob. Some plants are equipped to pack both whole grain and cream style at the same time while others have facilities for handling only one style of pack at a time. 16

If the corn is to be packed as WHOLE GRAIN style, the corn is single-cut close to the cob. After cutting, in many plants the kernels pass over an inspection belt where defective kernels are removed. The kernels are washed and then conveyed through silker machines to remove most of the remaining silks. Then the kernels are blanched to inactivate all enzymes before entering the filling machines. The fillers automatically fill each can to the desired level and add the packing medium. In the brine pack, which is the most common, the packing medium consists of water, sugar, and salt. When whole grain corn is "vacuum packed," about one ounce of packing medium is placed into the 12-ounce containers. The brine when added is preferably at boiling temperature. 17

If the corn is to be packed as CREAM style, it is usually cut more shallow than for whole grain and then the remaining portions of kernels are scraped from the cob. Canners occasionally double-cut the kernels, which when added to the cob scranings, presents a product with but little kernel character. Some packers claim that double-cut corn is desired by certain trade outlets but its popularity appears to be diminishing. It may often be noted that double cutting is done for the purpose of camouflaging advanced maturity. 18

From the cutters the corn is conveyed through the silkers to a mixing tank equipped with steam coils for heating. The common practice is to add a water, salt, and sugar mixture and bring the total mixture to the boiling point. Dry starch may be added and is usually added to the mixture when it is needed to thicken the consistency of very immature 19

corn. At this point the canner judges the consistency of the product, The amounts of liquid added to the mixture in the mixing tank depends largely upon the maturity of the corn. As the corn advances in maturity the natural sugars gradually revert to starch; thus the higher the starch content of the corn, the more the necessity for adding liquid to thin the product. Some plants are equipped with a relatively new type of consistency judging machine which electrically controls the degree of viscosity of the mixture. The properly heated cream-style mixture is filled into containers.

The packing of CORN ON COB has been temporarily restricted due to the War Production Board's tinplate conservation order. This style is not now included in the U. S. Standards. It is anticipated, however, that this style will be incorporated into the United States Standards when production is resumed again.

After the containers have been filled with corn, they are conveyed to the closing machine where the covers are sealed on the cans. Then the cans are moved to the retorts for processing.

Careful timing and observations of temperature is important, especially in cream style. Overcooking or under-cooling often caramelizes the sugar content of the corn, resulting in a darkened color and sometimes a scorched flavor. The cans must be cooled properly to dry the cans, but the product must be thoroughly cooled to the point where conditions of "stack burn" in storage will not occur.

The above is merely a brief outline of fairly typical operations. The order and method of procedure may be different in various sections of the country.

MAINTENANCE OF SANITATION UNDER CONTINUOUS FACTORY INSPECTION

For the benefit of inspectors who may have continuous inspection assignments in corn canning plants, it may be said that they are among the most difficult to maintain in a clean and sanitary condition.

Corn discharges a starchy liquid which congeals to a hard dryness within several hours. It is claimed that unhusked corn usually yields approximately one-third of its weight of a usable canning product. The remaining portions of inedible husks and cobs, together with the high speed operation of the husker and cutter machines, creates constant accumulations of waste on the floors and a film of dried starchy material over the machinery and equipment and on the walls of some portions of the factory building.

A clean plant operation usually requires one or more persons designated specifically for this work. Exposed wooden frameworks of machinery and equipment and wood floors soak up the natural juices of the corn, become sticky from the starch and sugar content, and sour quickly if not thoroughly cleaned at frequent intervals. Neither cold nor hot water will remove this gummy substance without considerable scrubbing, and only the use of live steam will gain the desired results. Thermophytic contamination becomes evident and "flat scours" will appear in the warehoused product if constant vigilance is not used in the plant and machinery clean-ups. This fact cannot be stressed too forcibly if a good sanitary condition within a corn canning plant is to be maintained.

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Another frequent and often hazardous condition encountered at corn canning plants is that of the location of the "shuck pile". This contains husks, cobs, and trimmings and is often stacked adjacent to the factory buildings. Corn waste is valuable for stock feed ensilage, yet when stacked too close to the factory buildings is highly undesirable, particularly if on a higher ground level than the buildings. Corn ensilage stacks sour quickly and unless proper drainage is provided the corn juices will accumulate at lower levels, become stagnant, and provide a vast breeding ground for flies. This is a serious problem around corn canning plants and everything that can be done to inhibit the increase of flies is desirable.

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GRADING

The preliminary procedures for the grading of canned corn are the same as for other canned products. Record the codes and can sizes on the score sheet, and take the net weight and vacuum readings. The information on commercial labels or sample labels should be recorded also.

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FILL OF CONTAINER

At the present time there is no applicable Standard of Fill of Container for Canned Corn set up by the Federal Food and Drug Administration. Therefore, the statements under "Prerequisites to Grading" in the current United States Standards for Grades of Canned Corn (effective December 1, 1932) are no longer in effect.

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The applicable Federal Specification, however, requires a fill which is stated in terms of maximum head space requirements. These headspace requirements mean that the product must occupy not less than 90 percent of the volume capacity of the container. An accurate method of determining whether the container is full in this respect is by use of a headspace gauge, measuring the vertical distance from the top of the double seam to the leveled surface of the contents.

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The maximum head space allowable, measured in sixteenths of an inch, for the can sizes commonly used for packing corn are:

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Can Size	Maximum Head Space (Sixteenths of an inch)
No. 1 (211 x 400)	8.8
12 oz. "Vacuum" (307 x 306)	Not applicable
No. 303 (303 x 406)	9.4
No. 2 (307 x 409)	9.7
No. 10 (603 x 700)	13.6
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Other containers (10% of the inside height of container).	
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6 - Grading of Canned Corn

In the event containers are found in which the headspace exceeds the maximum allowance, the statement after "net weight" in the body of the certificate should read, for example:

Net weight range 19-1/2 ounces to 20 ounces
(Excessive head space - range 9.9/16 inch to
10.3/16 inch)

As a matter of explanation, the common packing of "vacuum pack" corn is at present confined to 12 ounce (net weight) containers. This type of pack merely means that the corn has been packed or sealed under vacuum and the air has been expressed mechanically. In view of the method of packing, in which only a slight quantity of liquid (about one ounce of brine per 12-ounce can) is added, the headspace requirement is not applicable.

DRAINED WEIGHT

Drained weight of canned whole-grain corn is determined by emptying the contents evenly upon a circular sieve of the proper diameter containing 8 meshes to the inch (0.097-inch perforations). The drained weight is the weight of the sieve and whole-grain corn, less the weight of the dry sieve, after allowing to drain for exactly two minutes. A sieve 8 inches in diameter is used for No. 2 cans and smaller, and a sieve 12 inches in diameter is used for No. 10 cans.

The drained weights for canned whole-grain corn are:

Can Size	:Drained Weight
	: (in ounces)
No. 1 (211 x 400)	: 7-1/4
No. 303 (303 x 406)	: 11
No. 2 (307 x 409)	: 13-1/2
No. 10 (603 x 700)	: 72
Other containers, in proportion	

Determination of drained weights of "vacuum pack" whole-grain corn in 307 x 306 cans is rarely necessary, unless there is evidence at time of cut out of excessive liquid. The average net weight, however, should be not less than 12 ounces, which is the recognized net weight usually found on labels. In this connection, however, inspectors shall certify the net weight as found unless certification is based on Federal Specifications, which requires 12 ounces net weight for this size container.

STYLE AND COLOR

Since the issuance of the United States Standards for Grades of Canned Corn in 1932, the various styles and colors of corn have been incorporated into the "Standard of Identity" for canned vegetables. It is, therefore, necessary that labels on canned corn comply with the Food and Drug regulations in this respect, as follows:

"White sweet corn"	"Yellow sweet corn"
"White corn"	"Yellow corn"
"White sugar corn"	"Yellow sugar corn"
	"Golden sweet corn"
	"Golden corn"
"Field corn"	"Golden sugar corn"
"Whole grain"	"Cream style"
"Whole kernel"	"Crushed"
"Corn on cob"	

For the sake of uniformity in inspection certificates, the style and color shall be designated as follows:

Name of product . . . "CANNED CORN - CREAM STYLE"
 . . . "CANNED CORN - WHOLE-GRAIN STYLE"

"Color - White"

"Color - Golden"

Occasionally an applicant may request the inspector to indicate the variety on the certificate. When such requests are made, it will be permissible to make a statement under "Remarks" on the certificate in accordance with the following examples:

"Packer states that corn covered by this certificate is of Country Gentleman variety."

The inspector should never certify any individual variety within a type on the grade certificate.

SCORING GRADING FACTORS

Some packers claim that inspectors "take off score points" or score a quality factor downward without justification. Inspectors should be in position to justify each score assigned. This can always be done. In order to convince some packers, however, it is a good idea when convenient to show them by grading the product in their presence to point out the factors under consideration. This should not be done in the presence of a packer who tries to influence the judgment of the inspector or who interferes with the grading.

Inspectors should familiarize themselves with ideal quality under each scoring factor and score downward from this point. When a single scoring factor is found to be ideal (the best produced commercially nation-wide) the top score in the range for the factor should be assigned. The top of the score range should not be assigned unless the quality factor is truly ideal. It is not likely that all quality factors of the same sample will ever be ideal. One or more of the quality factors may be ideal and this state is more often attained in the case of color, cut, and consistency than it is in the case of maturity, flavor, and defects. Top score for either of the latter factors is not very often attained.

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COLOR

Color, a scoring factor for both cream-style and whole-grain corn, should be judged immediately upon emptying the corn from the container, because it has a tendency to become dull within a few minutes after it has been exposed to the air.

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In judging color uniformity, do not attempt to distinguish between shades of yellow or the casts of white, but judge the brightness of the kernels or cream as the corn is poured into the grading tray. The brightness of the color is principally affected by maturity, the more advanced stages causing the color to assume a dull, deep shaded appearance.

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Most varieties of Golden corn are pale in their immature stage, becoming a flat dull orange when overmature. Some of the processed corn will be of markedly different shades than others, even though grown under similar conditions and possessing the same maturity. The product of one factory may be of a pale yellow color when in the Grade A stage of maturity and another nearby plant may pack a product with similar maturity which will show a darker yellow or orange color. Therefore, it is important to score the factor of color on the basis of the uniformity of brightness or dullness of the kernels - the shade of yellow to orange should not influence the score points assigned.

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The White varieties are typically bright in the early stages of maturity for the most part, becoming progressively more gray with age. It may be noted occasionally, particularly when grading some of the hybrid varieties, that there will be present in the contents some "off-colored" kernels not typical of the variety. In Country Gentleman they are apt to be a bright yellow, whereas in the Silver Cross, Narrow Grain, and Evergreen varieties they may be either a bright yellow or a dark gray.

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Such off-colored kernels are usually the result of cross pollination of varieties in the field. Inasmuch as they detract from the general appearance of the product they should be scored under the factor of color. In many instances these off-colored kernels will be considerably more mature and harder than the typical product. Off-colored kernels are not to be confused with discolored kernels resulting from insect damage or deterioration.

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Although the same color requirements apply to both No. 2 and No. 10 cans, it is much more difficult to attain a rating in the (A) classification for No. 10 cans, particularly in white cream-style corn. This is due to the fact that No. 10 size cans of corn require a much longer cooking time in order for heat to penetrate to the center of the contents; and that they require a much longer cooling period. In scoring the color of canned corn in No. 10 containers the inspector should be a little lenient, especially if the product is near the (C) classification for the color factor alone. If the corn is caramelized to the extent that the flavor is affected, then this leniency is to be disregarded.

(A) To receive a score within the A classification, the color should be typically bright, practically uniform and typical of the variety or type. There should not be present more than 5 definitely "off-colored" (or off-variety) kernels per 20 ounces of net contents. 50

(B) Canned corn should be scored in the B range when the color is only reasonably bright, reasonably uniform, and typical of the variety or type. The color may be slightly dark due to caramelization or slightly lacking in brightness due to maturity or other causes. There should not be present more than 15 definitely "off-colored" (or off-variety) kernels per 20 ounces of net contents. 51

(C) Canned corn should be scored in the C range when it is dull in appearance. Dull appearing corn is usually due to advanced maturity, to darkening which often is noted when very immature corn is canned, and to darkening due to caramelization. Corn may show darkening from other causes, but regardless of the cause the color should not be severely affected. There should not be present more than 30 definitely "off-colored" (or off-variety) kernels per 20 ounces of net contents. 52

Corn that falls into the (C) classification shall not be graded above U. S. GRADE C (Standard), regardless of the total score for the product. 53

(D) Canned corn which is very dark or which does not meet the color requirements for the C range, should be scored in this classification. 54

Corn that falls into the (D) classification shall not be graded above OFF GRADE (Substandard), regardless of the total score for the product. 55

CONSISTENCY (FOR CREAM-STYLE CORN)

The factor of consistency is influenced by the stage of maturity of the corn; by the proportion of the liquid mixture added; by the amount of starch used, if any; and by the temperature of the product when the sample is cut. Cream-style corn should not be graded until at least a week, preferably ten days, after packing. 56

Prior to judging consistency, the contents shall have been thoroughly mixed, either by vigorously shaking the container before opening or by thoroughly stirring with a spoon. It is also important that the sample be at, or near, room temperature when graded. 57

The factor of consistency should always be judged within a period of two minutes after the contents are poured into the grading tray. 58

Occasionally inspectors will encounter cream-style corn which is granular (not smooth) and curdled in appearance, or in which the liquid separates freely from the mass when poured into the grading tray. These conditions have a bearing on the relative evaluation of consistency and should be taken into consideration when assigning the score for this factor. The score assigned will depend upon the effect these conditions have on the appearance of the product. 59

(A) Cream-style corn within the (A) classification for the factor of consistency will mound slightly toward the center, will have a very smooth, rich, cream-like finish, and there will be no evidence of free liquid (within two minutes) separating from the mass. 60

(B) The (B) classification for the factor of consistency allows for consistency that may be thinner, although not so thin as to run freely, or that may be thicker than a smooth, rich creamy appearance, but not so thick as to present a heavy appearance. 61

(C) The (C) classification for the factor of consistency covers corn with a consistency that either runs freely, but not so watery-thin as to be seriously objectionable; or that may be pasty-thick, but not so thick that the product will not pour out of the container. 62

(D) Corn that fails to meet the requirements of (C) classification for consistency so that it is seriously objectionable and watery-thin or pasty dry and crumbly shall be scored in the (D) classification. 63

Cream-style corn that falls into this classification for consistency shall not be graded above OFF-GRADE (Sub-standard), regardless of the total score for the product. 64

ABSENCE OF DEFECTS

The factor of absence of defects, applicable to both cream-style and whole-grain style corn, refers to the care exercised in the preparation of the product, the character of workmanship, and the degree of freedom from objectionable substances such as silks, husks, cob, pulled kernels, and insect damaged or otherwise deteriorated or discolored kernels. 65

Of the defects mentioned, silks may be considered the least objectionable, particularly the light-colored, fine silks that are not readily observed. Unless the presence of the darker silks is such that it substantially deters from the general appearance and edibility of the product, it may be given less weight than the other defects mentioned. 66

The determination of absence of defects in whole-grain corn may be ascertained on the grading tray and after the product has been checked for drained weight. 67

The determination of absence of defects in cream-style corn may be checked in a preliminary manner by "spooning" through the mixture in a methodical fashion. As a final check on the respective defects the sample, or a composite of several samples, if the lot appears to be uniform, should be washed under a gentle spray of water. An 8-mesh sieve is suitable for this purpose. A 12-inch diameter sieve is often practicable if on hand since many samples may be placed at equidistances without interfering with the identity of the samples examined. 68

(A) To receive a score within the (A) classification for absence of defects, the product must be practically free from defects. 69

"Practically free from defects" means that for each 20 ounces of net contents there may be present not more than 8 damaged and pulled kernels, including not more than half of this amount that may be seriously discolored; not more than one small particle of cob or particles of cob approximating the equivalent of one $1\frac{1}{4}$ -inch cube; and not more than $1\frac{1}{2}$ square inch of husk. Some silks may be present but they should be practically unnoticeable. 70

(B) If the product is reasonably free from defects, it may be scored within the (B) classification. 71

"Reasonably free from defects" means that for each 20 ounces of net contents there may be present not more than 16 damaged and pulled kernels, including not more than half of this amount that may be seriously discolored; not more than an aggregate of particles of cob approximating the equivalent of one $3\frac{1}{8}$ -inch cube; and not more than $3\frac{1}{4}$ square inch of husk. Some silks may be present but should not be very noticeable. 72

(C) If the product is fairly free from defects, it may be scored within the (C) classification. 73

"Fairly free from defects" means that for each 20 ounces of net contents there may be present not more than 30 damaged and pulled kernels, including not more than half of this amount that may be seriously discolored; not more than an aggregate of particles of cob approximating the equivalent of one $1\frac{1}{2}$ -inch cube; and not more than an aggregate of one square inch of husk. Silks may be present in a quantity that is noticeable and yet not seriously objectionable from appearance and eating standpoints. 74

(D) Corn that fails to meet the requirements of the (C) classification shall be scored in the (D) classification. 75

Corn that falls into this classification for absence of defects shall not be graded above OFF-GRADE (Substandard) regardless of the total score for the product. 76

CONFIDENTIAL - As a general rule the only foreign material encountered in canned corn which may be considered as in violation of the Food and Drug provisions is the presence of worms or worm fragments. A product found to contain worms or worm fragments, barring what may logically be deemed an accidental occurrence, should be reported on the certificate as follows:

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"Grade Not Certified, Account Presence Foreign Material
(worms and worm fragments)"

Inspectors should discuss with their supervisors what may be considered an "accidental occurrence" before certification is made.

78

CUT

The factor of cut relates to the evenness and regularity with which the kernels have been severed from the cob; that is, the effect that cut has on the appearance of the product. Irregularity or raggedness of cut shows up more readily in whole-grain style corn than in cream-style corn. The cut of cream-style corn may vary within a wide range - from (A) classification to (C) classification - and yet not impair the appearance to the degree that a similar cut would impair the quality of whole-grain style.

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Cut, therefore, is much more important in whole-grain corn than in cream-style. Since cream-style corn is prepared from cutting and scraping of kernels, the portion of kernels which are scraped from the cob will naturally contain some raggedness. The cut portion of the kernels, however, should be relatively even in cut (not in size). Unless the cut in cream-style corn definitely detracts from the appearance or eating quality of the corn it should be given the full scoring value in the (A) classification.

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The determination of cut in whole-grain style may be ascertained on the grading tray and after the product has been checked for drained weight.

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The determination of cut in cream-style corn should not be ascertained until a representative portion from the sample, or a composite of several samples, if the lot appears to be uniform, has been washed by spraying the cream from the corn. An eight inch, 8-mesh sieve is suitable for this purpose.

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(A) If the kernels appear to have been evenly severed from the cob, in the case of whole-grain, but including none of the cob tissue, a score in the (A) classification should be given. The kernels must be substantially intact and retain their natural characteristics.

83

(B) If the depth of cut is fairly irregular, slightly ragged in appearance, and the product is fairly free from empty hulls, the product may be scored within the (B) classification.

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(C) If the cut is uneven, ragged in appearance, with a considerable amount of empty hulls, the factor should be scored within the (C) classification. 85

(D) If the cut is so irregular as to present a very poor appearance, or the hulls are predominantly devoid of any kernel characteristic, the product should be scored in the (D) classification. 86

It is to be noted that a scoring in the (D) classification for CUT is not a limiting factor. 87

MATURITY

As corn matures the viscosity of the kernels changes from milky liquids to starchy solids. There are three commonly expressed stages of canned corn maturity as referred to in the United States Standards for Grades of Canned Corn: milk stage, cream stage, and dough stage. 88

These terms symbolize the consecutive brackets of Grades A, B, and C. An accurate interpretation of these three distinct maturity expressions is important to the proper classification of canned corn. Although the words "milk," "cream," and "dough" refer only to the degree of maturity of the interior of the kernel, the tenderness of the hulls is also considered under the factor of maturity. Occasionally, abnormal growing conditions with hot winds prevailing cause exceptionally firm hulls or long periods of dry weather may toughen the hulls. Inasmuch as the presence of tough hulls detracts from the edibility of the product it is appropriate that they be construed as a part of the kernel in the determination of tenderness. 89

Corn which is in the pre-milk stage of maturity is low in sugar content because the sugars have not as yet developed. In this stage the corn does not possess a typical sweet corn flavor and may usually be detected by its pale and transparent appearance. Such a product will often lose its kernel character after processing. 90

The milk stage of maturity refers to kernels of corn which, upon exerting a light pressure to the kernel between thumb and forefinger, emit a light, smooth, milky liquid or very thin light-bodied cream. Some kernels of very tender corn in this stage of maturity will "squirt" when a light pressure is applied. Other kernels slightly more mature, yet considered to be within this terminology, will enclose a very light-bodied smooth cream, and often together with a small portion of milk. Usually upon being lightly pinched the kernel will first emit a small amount of the milk, followed by the very light creamy center. 91

Kernels of corn may be said to be within the cream stage of maturity when, if moderate pressure is applied to the kernels between thumb and forefinger, it produces a smooth, creamy pulp, free from starchiness or granular texture or which has passed the milk stage described above. 92

Corn may be said to be within the dough stage of maturity when more than moderate pressure (or considerable pressure) between thumb and forefinger is necessary to force the contents from within the hull. The contents will consist of a heavy, pasty or granular pulp and will be of starchy texture. When in this stage of maturity the corn usually has a tendency to be "chewy." Corn which is beyond the dough stage of maturity is very low in natural sugar content, or of a hard granular texture, and usually very dull in color.

93

As the quality requirements for maturity in the United States Standards for Grades of Canned Corn are slightly higher for whole-grain style than for cream-style corn, the two will be discussed individually relative to ascertaining the maturity range. In arriving at a final conclusion of maturity, an inspector should correlate the findings of the pressure test with that based on the actual chewing or taste test.

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(A) - Whole-grain Style Corn

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To score in this classification the kernels must be predominantly within the milk stage, with none of the kernels past the very early cream stage. Although kernels may not be so immature as to "squirt" when pressure is applied between thumb and forefinger, they must possess a light-bodied, soft, creamy texture, and have tender hulls.

(A) - Cream-style Corn

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To score in this classification the kernels must be predominantly within the milk to early cream stage, with not more than one-fourth of the kernels in the cream stage but not late cream stage. The kernels must be tender, contain a light-bodied, soft, smooth, creamy consistency, and have tender hulls.

(B) - Whole-grain Style Corn

97

Corn within the cream stage may be scored within the (B) classification. The kernels must be tender but not as tender as requirements for (A) classification; must be of soft, smooth texture, but not as yet entering the dough stage. The kernels must possess reasonably tender hulls.

(B) - Cream-style Corn

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Corn within the cream stage may be scored within the (B) classification. The kernels must possess reasonably tender hulls.

(C) - Whole-grain Style Corn

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If the corn is entering into the dough stage, a score within the (C) classification should be given. The kernels will have lost a portion of their original moisture and as a result may show some evidence of denting or dimpling at the crowns. The contents of the kernel may be somewhat granular and somewhat starchy. The hulls may not be tender but are not seriously tough.

(C) - Cream-style Corn

100

The corn may be in the early dough stage, but not past the dough stage. The kernels may possess a somewhat matured, mealy, and slightly granular texture. The hulls may not be tender but are not seriously tough.

Corn that falls into the (C) classification shall not be graded above U. S. GRADE C (Standard), regardless of the total score for the product.

101

(D) - Whole-grain Style Corn

102

Corn that is more mature than the requirements for (C) classification must be scored in the (D) classification.

(D) - Cream-style Corn

103

Corn that is tough, hard, of a starchy, very granular texture, and past the dough stage, must be scored in the (D) classification.

Corn that falls into the (D) classification shall not be graded above OFF-GRADE (Substandard) regardless of the total score for the product.

104

FLAVOR

In most instances, but not necessarily always, flavor follows within close proximity the score range assigned for maturity. Corn that falls within the top (B) range for maturity will sometimes possess a flavor worthy of scoring in the (A) classification and conversely, but not often, the maturity range may fall in the (A) classification and possess a flavor worthy only of (B) classification.

105

In most instances, flavor of canned corn may be scored within the same grade range as maturity. Maturity generally reflects flavor if no abnormal condition exists such as caramelization, fermentation, or lack of or excess of salt or sugar. Corn packers occasionally receive special orders for canned corn packed without sugar or salt, destined for consumption by patients suffering from diabetes or similar ailments. Special packs of this nature will have a corn flavor, but taste very flat due only to the lack of condiments. When it is noted

106

that the sample apparently contains no condiments the packer should be contacted for verification. If the lot is intended for trade channels for dietary use and the condiments are purposely omitted then the lot should be certified in the usual way (as to Grade) except for the added statement under "Remarks," -

107

"Packer states that lot was packed without added sugar or salt."

This enables us to certify the lot for its full intended value in favor of the purpose for which the product was packed.

Flavor should be scored down or up in close proximity to the relative maturity score assigned unless a definite flavor is present which makes it necessary to assign a score at considerable variance from the relative maturity score. Flavor as an independent factor should not be judged purely on a basis of personal preference as this leaves too much to the "human element" and leads to lack of uniformity within the inspection force.

108

MANDATORY REQUIREMENTS

There are no established minimum standards of quality under the Federal Food, Drug, and Cosmetic Act for canned corn at the present time. Requirements of a general nature, such as adulteration, presence of a filthy substance, are applicable to canned corn as for all food commodities. Any can of corn, therefore, that fails to meet U. S. GRADE C (Standard) and is graded as OFF-GRADE (Substandard) does not become "Below Standard in Quality."

109

There is a standard of identity for canned corn which covers the form (or style) of the vegetable ingredients, and the common name, as explained previously under "Style and Color." The item of canned corn is further defined as permitting the following optional seasoning ingredients which may be added in a quantity sufficient to season the food; salt, a vinegar, spice, refined sugar (sucrose), refined corn sugar (dextrose).

110

In addition, "Starch, in the cases of white sweet corn (cream-style or crushed form) and yellow sweet corn (cream-style or crushed form), in a quantity not more than sufficient to insure smoothness." If starch is present, the standard identity requires that the label shall bear this statement:

111

"Starch Added to Insure Smoothness."

The inspector should not certify that "Starch has been added to the product." Since label statements carry this information, this portion of the label should be quoted, if the goods are labeled.

112

TOLERANCE FOR CERTIFICATION OF OFFICIALLY DRAWN SAMPLES

When certifying samples which have been officially drawn and which represent a specific lot of canned corn, the grade will be determined by averaging the score of all containers, provided not more than one-sixth of the containers fail in some respect to meet the requirements of the grade indicated by the average score. 113

However, none of the cans may fall more than 4 points below the minimum score for the grade indicated by the average score, and if one-sixth or less of the containers fail to meet the requirements of the indicated grade by reason of a limiting rule, the average score of all containers for the limiting factor must be within the range for the grade indicated by the average total score. 114

This tolerance does not apply if any container falls below any applicable standard of quality promulgated under the Federal Food, Drug, and Cosmetic Act. 115

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This handbook article has been written as an intended help to the inspectors in interpreting the current United States Standards for Grades of Canned Corn. The descriptive words and specific tolerance within the grading factors and grade classifications are meant only as a guide. Special instances may be encountered which will require that the inspector use his personal judgment or he may wish to refer samples to his supervisor before rendering final judgment. It is believed, however, that if the inspector adheres closely to handbook instructions when grading corn, more uniform decisions will result. Before the inspector deviates substantially from the interpretations as described in this handbook article he should contact his supervisor first, who in turn may wish to contact the Regional Supervisor or the Washington office. 116

